

The documentation and process conversion measures necessary to comply with this document shall be completed by 24 August 2010.

INCH-POUND

MIL-PRF-19500/301K
24 May 2010
SUPERSEDING
MIL-PRF-19500/301J
12 October 2007

PERFORMANCE SPECIFICATION SHEET

* SEMICONDUCTOR DEVICE, TRANSISTOR, NPN SILICON, LOW-POWER,
TYPE 2N918 AND 2N918UB,
JAN, JANTX, JANTXV, AND JANS, JANHC, JANKC, AND JANHCB

This specification is approved for use by all Departments
and Agencies of the Department of Defense.

The requirements for acquiring the product described herein shall consist of
this specification sheet and MIL-PRF-19500.

1. SCOPE

1.1 Scope. This specification covers the detail requirements for NPN, silicon, ultra-high frequency transistors. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500 and two levels of product assurance are provided for unencapsulated devices.

* 1.2 Physical dimensions. See figure 1 (TO-72), figure 2 for UB, figure 3 (JANHC and JANKC), and figure 4 (JANHCB).

1.3 Maximum ratings. $T_A = +25^\circ\text{C}$, unless otherwise specified.

| Types | P_T (1) $T_A = +25^\circ\text{C}$ | $R_{\theta JC}$ | V_{CBO} | V_{CEO} | V_{EBO} | I_C | T_{STG} and T_J |
|---------|--|--------------------------------------|-------------|-------------|-------------|--------------|------------------------------------|
| | <u>mW</u> | <u>$^\circ\text{C/W}$</u> | <u>V dc</u> | <u>V dc</u> | <u>V dc</u> | <u>mA dc</u> | <u>$^\circ\text{C}$</u> |
| 2N918 | 200 | (2) | 30 | 15 | 3.0 | 50 | -65 to +200 |
| 2N918UB | 200 | (2) | 30 | 15 | 3.0 | 50 | |

(1) Derate linearly, 1.14 mW/ $^\circ\text{C}$ above $T_A = +25^\circ\text{C}$.

(2) Contact manufacturer for $R_{\theta JC}$ estimates.

1.4 Primary electrical characteristics at $T_A = +25^\circ\text{C}$.

| Limit | $ h_{FE} $ | $r_b' C_c$ | C_{obo2} | NF | G_{pe} |
|---------|--|--|--|--|--|
| | $V_{CE} = 10 \text{ V dc}$ $I_C = 4 \text{ mA dc}$ $f = 100 \text{ MHz}$ | $V_{CB} = 10 \text{ V dc}$ $I_E = -4.0 \text{ mA dc}$ $f = 79.8 \text{ MHz}$ | $V_{CB} = 10 \text{ V dc}$ $I_E = 0 \text{ mA dc}$ $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$ | $V_{CE} = 6 \text{ V dc}$ $I_C = 1 \text{ mA dc}$ $f = 60 \text{ MHz}$ $g_s = 2.5 \text{ mmho}$ | $V_{CB} = 12 \text{ V dc}$ $I_C = 6.0 \text{ mA dc}$ $f = 200 \text{ MHz}$ |
| | | <u>ps</u> | <u>pF</u> | <u>DB</u> | <u>dB</u> |
| Minimum | 6.0 | | | | 15 |
| Maximum | 18.0 | 25 | 1.7 | 6.0 | |

* Comments, suggestions, or questions on this document should be addressed to Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to Semiconductor@dsc.dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.daps.dla.mil>.

1.4 Primary electrical characteristics at $T_A = +25^\circ\text{C}$. - Continued.

| Limit | h_{FE1} $V_{CE} = 10\text{ V dc}$ $I_C = 500\text{ }\mu\text{A dc}$ | h_{FE2} $V_{CE} = 1.0\text{ V dc}$ $I_C = 3.0\text{ mA dc}$ | h_{FE3} $V_{CB} = 10\text{ V dc}$ $I_C = 10\text{ mA dc}$ |
|---------|---|---|---|
| Minimum | 10 | 20 | 20 |
| Maximum | | 200 | |

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-19500 - Semiconductor Devices, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-750 - Test Methods for Semiconductor Devices.

* (Copies of these documents are available online at <https://assist.daps.dla.mil/quicksearch> or <https://assist.daps.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

* 2.3 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

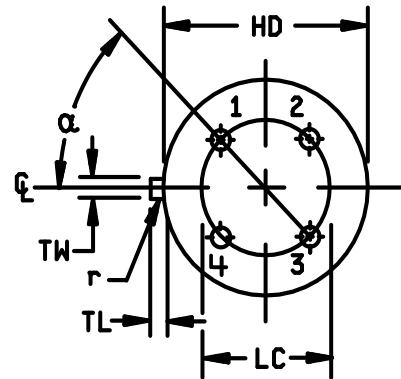
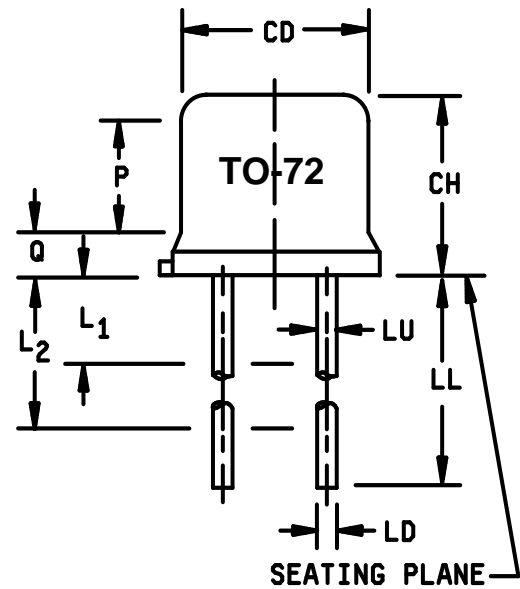
3.1 General. The individual item requirements shall be as specified in MIL-PRF-19500 and as modified herein.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list (QML) before contract award (see 4.2 and 6.3).

3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500 and as follows.

g_s Noise source conductance.
 P_o Oscillator, power output.
 R_{BE} External resistance, base to emitter.

| Symbol | Dimensions | | | | Notes |
|----------------|------------|------|-------------|-------|-------|
| | Inches | | Millimeters | | |
| | Min | Max | Min | Max | |
| CD | .178 | .195 | 4.52 | 4.95 | 5 |
| CH | .170 | .210 | 4.32 | 5.33 | |
| HD | .209 | .230 | 5.31 | 5.84 | 5 |
| LC | .100 TP | | 2.54 TP | | 7,8 |
| LD | .016 | .021 | .406 | .533 | 7,8 |
| LL | .500 | .750 | 12.70 | 19.05 | 7,8 |
| LU | .016 | .019 | .406 | .483 | |
| L ₁ | | .050 | | 1.27 | |
| L ₂ | .250 | | 6.35 | | |
| P | .100 | | 2.54 | | |
| Q | | .040 | | 1.02 | 5 |
| TL | .028 | .048 | .71 | 1.22 | |
| TW | .036 | .046 | .91 | 1.17 | |
| r | | .007 | | .18 | |
| α | 45° TP | | | | |

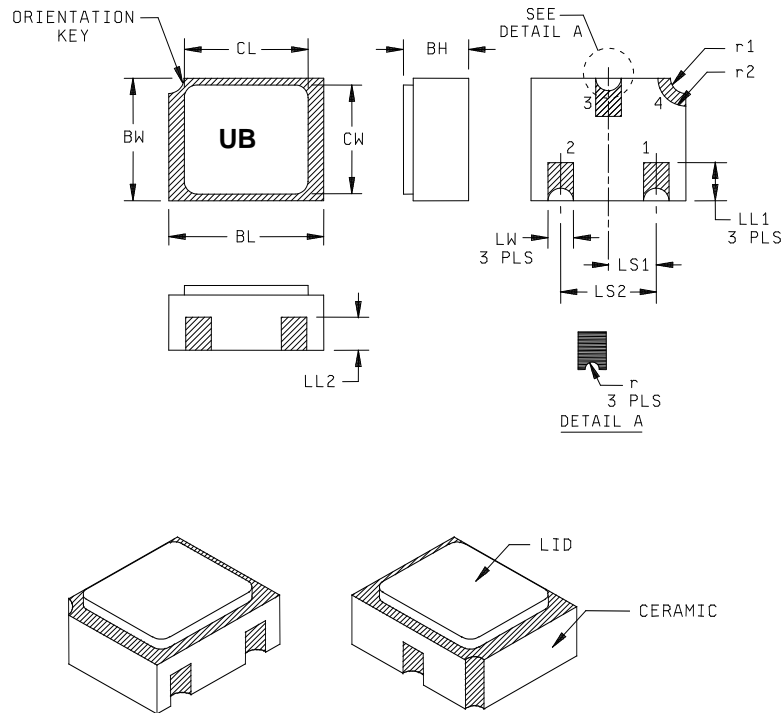


NOTES:

1. Dimension are in inches.
2. Millimeters are given for general information only.
3. Beyond r (radius) maximum, TH shall be held for a minimum length of .011 inch (0.28 mm).
4. Dimension TL measured from maximum HD.
5. Body contour optional within zone defined by HD, CD, and Q.
6. Leads at gauge plane .054 +.001 -.000 inch (1.37 +0.025 -0.00 mm) below seating plane shall be within .007 inch (0.18mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC.
7. Dimension LU applies between L₁ and L₂. Dimension LD applies between L₂ and LL minimum. Diameter is uncontrolled in L₁ and beyond LL minimum.
8. All four leads.
9. Dimension r (radius) applies to both inside corners of tab.
10. In accordance with ASME Y14.5M, diameters are equivalent to ϕ x symbology.
11. Lead 1 = emitter, lead 2 = base, lead 3 = collector, lead 4 = case (electrically connected).

FIGURE 1. Physical dimensions for 2N918 (TO-72).

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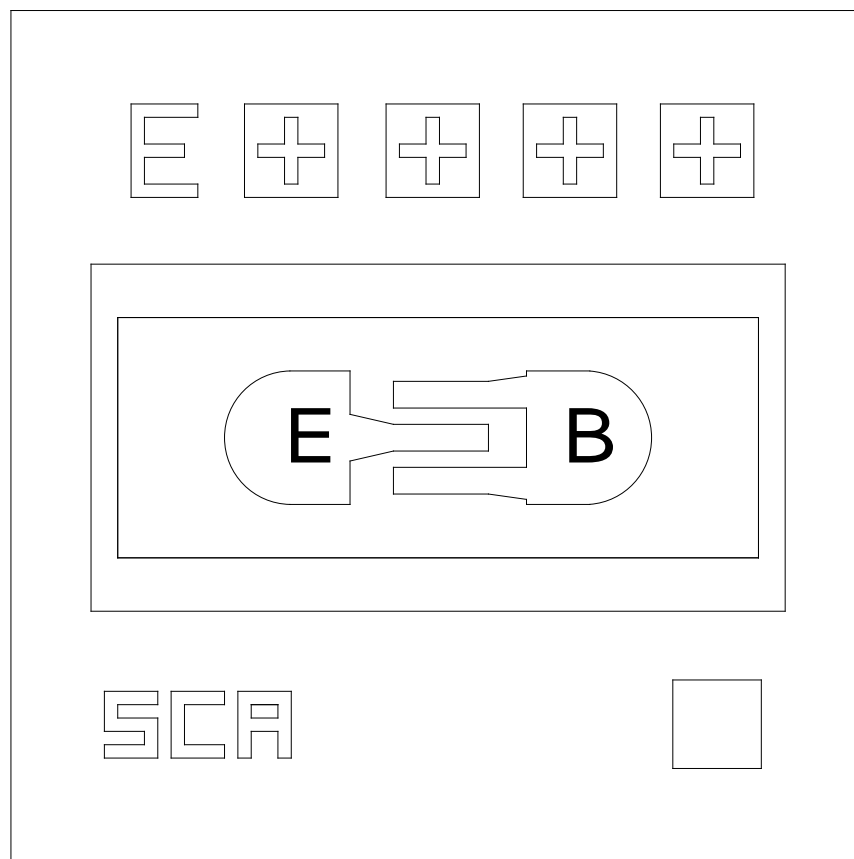
| Symbol | Dimensions | | | | Note |
|--------|------------|------|-------------|------|------|
| | Inches | | Millimeters | | |
| | Min | Max | Min | Max | |
| BH | .046 | .056 | 1.17 | 1.42 | |
| BL | .115 | .128 | 2.92 | 3.25 | |
| BW | .085 | .108 | 2.16 | 2.74 | |
| CL | | .128 | | 3.25 | |
| CW | | .108 | | 2.74 | |
| LL1 | .022 | .038 | 0.56 | 0.97 | |
| LL2 | .017 | .035 | 0.43 | 0.89 | |

| Symbol | Dimensions | | | | Note |
|-----------------|------------|------|-------------|------|------|
| | Inches | | Millimeters | | |
| | Min | Max | Min | Max | |
| LS ₁ | .036 | .040 | 0.91 | 1.02 | |
| LS ₂ | .071 | .079 | 1.80 | 2.01 | |
| LW | .016 | .024 | 0.41 | 0.61 | |
| r | | .008 | | .203 | |
| r1 | | .012 | | .305 | |
| r2 | | .022 | | .559 | |
| | | | | | |

NOTES:

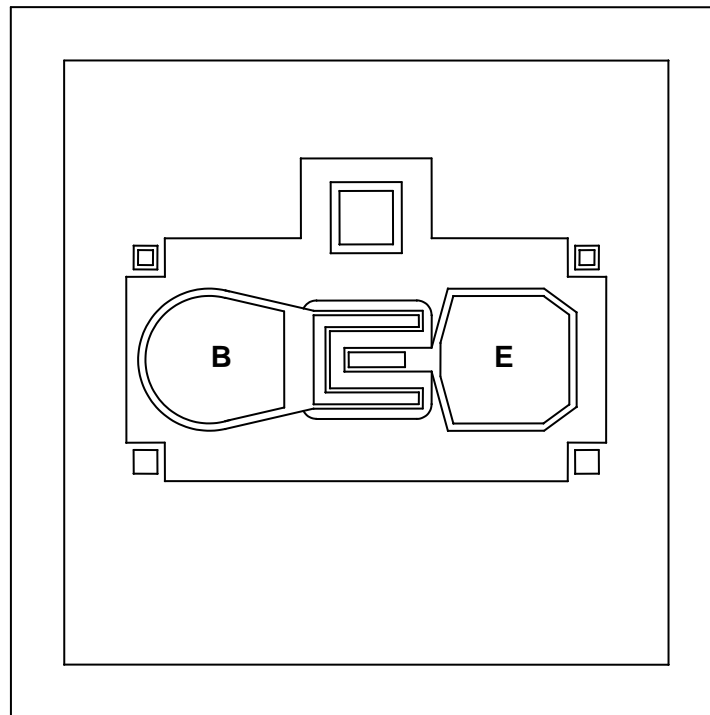
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Hatched areas on package denote metallized areas.
4. Lid material: Kovar.
5. Pad 1 = Base, Pad 2 = Emitter, Pad 3 = Collector, Pad 4 = Shielding connected to the lid.
6. In accordance with ASME Y14.5M, diameters are equivalent to ϕ x symbology.

* FIGURE 2. Physical dimensions for 2N918UB, surface mount.



| | |
|------------------|--|
| Die size----- | .016 x .016 inch, (0.406 mm X 0.406 mm). |
| Die thickness--- | .008 ±.0016 inch, (0.203 mm ± 0.0406 mm). |
| Base pad----- | .0027 x .0027 inch, (0.069 mm X 0.069 mm). |
| Emitter pad----- | .0027 x .0027 inch, (0.069 mm X 0.069 mm). |
| Back metal----- | Gold, 6,500 ±1,950 Å. |
| Top metal----- | Aluminum, 17,500 ±2,500 Å. |
| Back side----- | Collector. |
| Glassivation--- | SiO ₂ , 7,500 ±1,500 Å. |

FIGURE 3. JANHC and JANKC (A-version) die dimensions.



| | |
|------------------|---|
| Die size----- | .017 x .017 inch, (0.432 mm X 0.432 mm). |
| Die thickness--- | .010 ±.0016 inch, (0.254 mm ± 0.041 mm). |
| Base pad----- | .0030 x .0027 inch, (0.076 mm X 0.069 mm). |
| Emitter pad----- | .00275 x .0027 inch, (0.070 mm X 0.069 mm). |
| Back metal----- | Gold, 3,500 Å minimum, 5,000 Å nominal. |
| Top metal----- | Aluminum, 10,000 Å 12,000 Å nominal. |
| Back side----- | Collector. |

* FIGURE 4. JANHCB (B-version) die dimensions.

* 3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and figure 1 (TO-72), 2 (surface mount UB), 3 (die), and 4 (die) herein.

3.4.1 Lead finish. Lead finish shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

3.5 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4, and table I herein.

3.6 Electrical test requirements. The electrical test requirements shall be as specified in table I.

3.7 Marking. Marking shall be in accordance with MIL-PRF-19500, except for the UB suffix package. Marking on the UB package shall consist of an abbreviated part number, the date code, and the manufacturers symbol or logo. The prefixes JAN, JANTX, JANTXV, and JANS can be abbreviated as J, JX, JV, and JS respectively. The "2N" prefix and the "UB" suffix can also be omitted.

3.8 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.2).
- b. Screening (see 4.3).
- c. Conformance inspection (see 4.4 and tables I and II).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

4.2.1 JANHC and JANKC qualification. JANHC and JANKC qualification inspection shall be in accordance with MIL-PRF-19500.

4.2.2 Group E qualification. Group E inspection shall be performed for qualification or re-qualification only. In case qualification was awarded to a prior revision of the specification sheet that did not request the performance of table III tests, the tests specified in table III herein that were not performed in the prior revision shall be performed on the first inspection lot of this revision to maintain qualification.

4.2.2.1 Group E thermal response. With extremely small junction devices such as this one, a true thermal impedance cannot be measured, only calculated. While "thermal response" has been substituted for "thermal impedance" herein, the terms, units, and procedures are essentially unchanged. Each supplier shall submit a thermal response ($Z_{\theta JX}$) histogram of the entire qualification lot. The histogram data shall be taken prior to the removal of devices that are atypical for thermal response. Thermal response curves (from $Z_{\theta JX}$ test pulse time to $R_{\theta JX}$ minimum steady-state time) of the best device in the qual lot and the worst device in the qual lot (that meets the supplier proposed screening limit), or from the thermal grouping, shall be submitted. The optimal test conditions and proposed initial thermal response screening limit shall be provided in the qualification report. Data indicating how the optimal test conditions were derived for $Z_{\theta JX}$ shall also be submitted. The proposed maximum thermal response $Z_{\theta JX}$ screening limit shall be submitted. The qualifying activity may approve a different $Z_{\theta JX}$ limit for conformance inspection end-point measurements as applicable. Equivalent data, procedures, or statistical process control plans may be used for part, or all, of the above requirements. The approved thermal response conditions and limit for $Z_{\theta JX}$ shall be used by the supplier in screening and table I, subgroup 2. The approved thermal resistance conditions for $R_{\theta JX}$ shall be used by the supplier for conformance inspection. For product families with similar thermal characteristics based on the same physical and thermal die, package, and construction combination (thermal grouping), the supplier may use the same thermal response curves.

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4.3 Screening. Screening shall be in accordance with table E-IV of MIL-PRF-19500, and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

| Screen (see table E-IV of MIL-PRF-19500) | Measurement | |
|--|--|---|
| | JANS level | JANTX and JANTXV levels |
| (1) 3c | Thermal impedance, method 3131 of MIL-STD-750 (see 4.3.3). | Thermal impedance, method 3131 of MIL-STD-750 (see 4.3.3). |
| 9 | I_{CBO1} and h_{FE2} | |
| 11 | I_{CBO1} and h_{FE2} ΔI_{CBO1} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE2} = ± 15 percent. | I_{CBO1} and h_{FE2} |
| 12 | See 4.3.2 | See 4.3.2 |
| 13 | Subgroups 2 and 3 of table I herein; ΔI_{CBO1} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE2} = ± 15 percent. | Subgroup 2 of table I herein; ΔI_{CBO1} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE2} = ± 20 percent. |

(1) Shall be performed anytime after temperature cycling, screen 3a; and does not need to be repeated in screening requirements.

4.3.1 Screening (JANHNC and JANKC). Screening of JANHC and JANKC die shall be in accordance with MIL-PRF-19500, "Discrete Semiconductor Die/Chip Lot Acceptance". Burn-in duration for the JANKC level follows JANS requirements; the JANHC follows JANTX requirements.

4.3.2 Power burn-in conditions. Power burn-in conditions are as follows: 2N918, UB, $V_{CB} = 5 - 15$ V dc, $P_T = 200$ mW at T_A = room ambient as defined in the general requirements of 4.5 in MIL-STD-750. NOTE: No heat sink or forced air cooling on the devices shall be permitted.

4.3.3 Thermal impedance (ΔV_{BE} measurements). The ΔV_{BE} measurements shall be performed in accordance with method 3131 of MIL-STD-750 using the guidelines in that method for determining V_H , V_{CE} , I_M , I_H , t_H , and t_{MD} . The ΔV_{BE} limit used in screen 3c and table I, subgroup 2 shall be set statistically by the supplier over several die lots and submitted to the qualifying activity for approval.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein. Group A inspection shall be performed on each subplot.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500 and table I herein.

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4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the tests and conditions specified for subgroup testing in table E-VIa (JANS) and table E-VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and 4.4.2.1 and 4.4.2.2 herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. Delta measurements shall be in accordance with table II herein.

* 4.4.2.1 Group B inspection, table E-VIa (JANS) of MIL-PRF-19500.

| <u>Subgroup</u> | <u>Method</u> | <u>Conditions</u> |
|-----------------|---------------|--|
| B3 | 2037 | Test condition A. All internal leads for each device shall be pulled separately. |
| B4 | 1037 | $V_{CB} = 10 \text{ V dc}$, 2,000 cycles, $t_{ON} = t_{OFF} = 3 \text{ minutes}$, $P_{D(ON)} = P_D \text{ max rated in accordance with 1.3}$; $P_{D(OFF)} = 0$. |
| B5 | 1027 | $V_{CB} = 10 \text{ V dc}$; 1,000 hours maximum rated power shall be applied and ambient temperature adjusted to achieve $T_J = +150^\circ\text{C}$ minimum. $n = 45$, $c = 0$. |

* 4.4.2.2 Group B inspection, table E-VIb (JAN, JANTX, and JANTXV). Separate samples may be used for each step. In the event of a group B failure, the manufacturer may pull a new sample at double size from either the failed assembly lot or from another assembly lot from the same wafer lot. If the new "assembly lot" option is exercised, the failed assembly lot shall be scrapped.

| <u>Step</u> | <u>Method</u> | <u>Conditions</u> |
|-------------|---------------|---|
| * 1 | 1026 | Steady-state life: 1,000 hours, $V_{CB} = 10 \text{ V dc}$, power shall be applied to achieve $T_J = +150^\circ\text{C}$ minimum using a minimum of $P_D = 100 \text{ percent of maximum rated } P_T$ as defined in 1.3; in addition, adjust T_A to achieve T_J . $n = 45 \text{ devices}$, $c = 0$. |
| 2 | 1048 | Blocking life: $T_A = +150^\circ\text{C}$, $V_{CB} = 80 \text{ percent of rated voltage}$, 48 hours minimum. $n = 45 \text{ devices}$, $c = 0$. |
| 3 | 1032 | High temperature life (non-operating), $t = 340 \text{ hours}$; $T_A = +200^\circ\text{C}$. $n = 22$, $c = 0$. |

4.4.2.3 Group B sample selection. Samples selected from group B inspection shall meet all of the following requirements:

- For JAN, JANTX, and JANTXV samples shall be selected randomly from a minimum of three wafers (or from each wafer in the lot) from each wafer lot. For JANS, samples shall be selected from each inspection lot. See MIL-PRF-19500.
- Shall be chosen from an inspection lot that has been submitted to and passed table I, subgroup 2 conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for life test (subgroups B4 and B5 for JANS, and group B for JAN, JANTX, and JANTXV) may be pulled prior to the application of final lead finish.

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4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the tests and conditions specified for subgroup testing in table E-VII of MIL-PRF-19500, and in 4.4.3.1 (JANS) and 4.4.3.2 (JAN, JANTX, and JANTXV) herein for group C testing. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. Delta measurements shall be in accordance with table II herein.

* 4.4.3.1 Group C inspection, table E-VII (JANS) of MIL-PRF-19500.

| <u>Subgroup</u> | <u>Method</u> | <u>Conditions</u> |
|-----------------|---------------|---|
| C2 | 2036 | Test condition E, not applicable for UB devices. |
| * C5 | 3131 | See 1.3 herein. |
| C6 | 1026 | $V_{CB} = 10$ V dc, 1,000 hours; maximum rated power shall be applied and ambient temperature adjusted to achieve $T_J = +150^\circ\text{C}$ minimum. $n = 45$ devices, $c = 0$. For small lots, $n = 12$ devices, $c = 0$. The sample size may be increased and the test time decreased as long as the devices are stressed for a total of 45,000 device hours minimum, and the actual time of test is at least 340 hours. |

* 4.4.3.2. Group C inspection, table E-VII (JAN, JANTX, and JANTXV) of MIL-PRF-19500.

| <u>Subgroup</u> | <u>Method</u> | <u>Condition</u> |
|-----------------|---------------|--|
| C2 | 2036 | Test condition E; not applicable for UB devices. |
| * C5 | 3131 | See 1.3 herein. |
| C6 | | Not applicable. |

4.4.3.3 Group C sample selection. Samples for subgroups in group C shall be chosen at random from any inspection lot containing the intended package type and lead finish procured to the same specification which is submitted to and passes table I tests for conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for C6 life test may be pulled prior to the application of final lead finish. Testing of a subgroup using a single device type enclosed in the intended package type shall be considered as complying with the requirements for that subgroup.

4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table E-IX of MIL-PRF-19500 and as specified in table III herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. Delta measurements shall be in accordance with table II herein.

4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows.

4.5.1 Input capacitance. This test shall be conducted in accordance with method 3240 of MIL-STD-750 except that the output capacitor shall be omitted.

4.5.2 Disposition of case lead during electrical measurements. Unless otherwise specified all electrical measurements and operating life test shall be performed with the case lead connected to the emitter.

4.5.3 Noise figure. The noise figure shall be measured using commercially available test equipment and its associated standard test procedures (see figure 4).

4.5.4 Collector-base time constant. This parameter may be determined by applying an rf signal voltage of 1.0 volt (rms) across the collector-base terminals, and measuring the ac voltage drop (V_{eb}) with a high-impedance rf voltmeter across the emitter-base terminals. With $f = 79.8$ MHz used for the 1.0 volt signal, the following computation applies:

$$r_b' C_c: (\text{psec}) = 2 \times V_{eb} (\text{millivolts})$$

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* TABLE I. Group A inspection.

| Inspection <u>1/</u> | MIL-STD-750 | | Symbol | Limits | | Unit |
|---|-------------|---|----------------------|--------|-----|-------|
| | Method | Conditions | | Min | Max | |
| <u>Subgroup 1 2/</u> | | | | | | |
| Visual and mechanical examination <u>3/</u> | 2071 | n = 45 devices, c = 0 | | | | |
| Solderability <u>3/ 4/</u> | 2026 | n = 15 leads, c = 0 | | | | |
| Resistance to solvents <u>3/ 4/ 5/</u> | 1022 | n = 15 devices, c = 0 | | | | |
| Temp cycling <u>3/ 4/</u> | 1051 | Test condition C, 25 cycles. n = 22 devices, c = 0 | | | | |
| Hermetic seal <u>4/</u> Fine leak Gross leak | 1071 | n = 22 devices, c = 0 Test conditions G or H Test conditions C or D | | | | |
| Electrical measurements <u>4/</u> | | Table I, subgroup 2 | | | | |
| Bond strength <u>3/ 4/</u> | 2037 | Precondition T _A = +250°C at t = 24 hrs or T _A = +300°C at t = 2 hrs n = 11 wires, c = 0 | | | | |
| Decap internal visual (design verification) <u>4/</u> | 2075 | n = 4 devices, c = 0 | | | | |
| <u>Subgroup 2</u> | | | | | | |
| Thermal impedance <u>6/</u> | 3131 | See 4.3.3 | ΔV _{BE} | | | |
| Collector to base cutoff current | 3036 | Bias condition D, V _{CBO} = 30 V | I _{CBO2} | | 1 | μA dc |
| Breakdown voltage, collector to emitter | 3011 | Bias condition D, I _C = 3.0 mA dc | V _{(BR)CEO} | 15 | | V dc |
| Emitter to base cutoff current | 3061 | Bias condition D, V _{EB} = 3 V | I _{EBO2} | | 10 | μA dc |
| Collector to base cutoff current | 3036 | Bias condition D, V _{CB} = 25 V dc | I _{CBO1} | | 10 | nA dc |
| Emitter to base cutoff current | 3061 | Bias condition D, V _{EB} = 2.5 V dc | I _{EBO1} | | 10 | nA dc |
| Forward-current transfer ratio | 3076 | V _{CE} = 10 V dc; I _C = 500 μA dc | h _{FE1} | 10 | | |
| Forward-current transfer ratio | 3076 | V _{CE} = 1.0 V dc; I _C = 3.0 mA dc | h _{FE2} | 20 | 200 | |
| Forward-current transfer ratio | 3076 | V _{CE} = 10 V dc; I _C = 10 mA dc | h _{FE3} | 20 | | |

See footnotes at end of table.

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* TABLE I. Group A inspection - Continued.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limits | | Unit |
|--|-------------|--|---------------------------------|--------|-----|-------|
| | Method | Conditions | | Min | Max | |
| <u>Subgroup 2</u> - Continued. | | | | | | |
| Collector to emitter voltage (saturated) | 3071 | I _C = 10 mA dc; I _B = 1.0 mA dc | V _{CE(sat)} | | 0.4 | V dc |
| Base to emitter voltage (saturated) | 3066 | Test condition A; I _C = 10 mA dc; I _B = 1.0 mA dc | V _{BE(sat)} | | 1.0 | V dc |
| <u>Subgroup 3</u> | | | | | | |
| High temperature operation | | T _A = +150°C | | | | |
| Collector to base cutoff current | 3036 | Bias condition D, V _{CB} = 25 V dc | I _{CBO2} | | 1.0 | μA dc |
| Low-temperature operation | | T _A = -55°C | | | | |
| Forward-current transfer ratio | 3076 | V _{CE} = 1.0 V dc; I _C = 3.0 mA dc | h _{FE4} | 10 | | |
| <u>Subgroup 4</u> | | | | | | |
| Open circuit output capacitance | 3236 | V _{CB} = 0 V dc; I _E = 0, 100 kHz ≤ f ≤ 1 MHz | C _{obo1} | | 3.0 | pF |
| Open circuit output capacitance | 3236 | V _{CB} = 10 V dc; I _E = 0, 100 kHz ≤ f ≤ 1 MHz | C _{obo2} | | 1.7 | pF |
| Input capacitance (output open circuited) | 3240 | V _{EB} = 0.5 V dc; I _C = 0, 100 kHz ≤ f ≤ 1 MHz | C _{ibo} | | 2.0 | pF |
| Magnitude of common emitter, small-signal short-circuit forward current transfer ratio | 3306 | V _{CE} = 10 V dc; I _C = 4.0 mA, f = 100 MHz | h _{FE} | 6.0 | 18 | |
| Noise figure | | V _{CE} = 6 V dc; I _C = 1.0 mA dc; f = 60 MHz; g _s = 2.5 mmho (see 4.5.2, 4.5.3, and figure 5) | NF | | 6.0 | dB |
| Small-signal power gain | 3256 | V _{CB} = 12 V dc; I _C = 6.0 mA dc; f = 200 MHz; (see figure 6) | G _{pe} | 15 | | dB |
| Collector-base time constant | | V _{CB} = 10 V dc; I _E = -4.0 mA dc; f = 79.8 MHz (see 4.5.2 and 4.5.4) | r _b ' C _c | | 25 | ps |

See footnotes at end of table.

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* TABLE I. Group A inspection - Continued.

| Inspection <u>1</u> / | MIL-STD-750 | | Symbol | Limits | | Unit |
|--------------------------------|-------------|---|--------|--------|-----|------|
| | Method | Conditions | | Min | Max | |
| <u>Subgroup 4</u> - Continued. | | | | | | |
| Oscillator power output | | $V_{CB} = 15 \text{ V dc}; I_C = 8.0 \text{ mA dc}; f \geq 500 \text{ MHz}$ (see figure 7) | P_o | 30 | | mW |
| Collector efficiency | | $V_{CB} = 15 \text{ V dc}; I_C = 8.0 \text{ mA dc}; f \geq 500 \text{ MHz}$ (see figure 7) | η | 25 | | % |
| <u>Subgroup 5</u> | | | | | | |
| Not applicable | | | | | | |

1/ For sampling plan (unless otherwise specified see MIL-PRF-19500.

2/ For resubmission of failed subgroup 1, double the sample size of the failed test or sequence of tests. A failure in table I, subgroup 1 shall not require retest of the entire subgroup. Only the failed test shall be rerun upon submission.

3/ Separate samples may be used.

4/ Not required for JANS devices.

5/ Not required for laser marked devices.

6/ This test required for the following end-point measurement only:

Group B, subgroups 2 and 3 (JANTX and JANTXV).

Group B, subgroups 3, 4, and 5 (JANS).

Group C, subgroups 2 and 6.

Group E, subgroups 1 and 2.

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TABLE II. Groups B, C, and E delta electrical measurements. 1/ 2/ 3/ 4/

| Step | Inspection | MIL-STD-750 | | Symbol | Limits | | Unit |
|------|---------------------------------------|-------------|---|--------------------------------|--|-----|------|
| | | Method | Conditions | | Min | Max | |
| 1. | Collector-base cutoff current | 3036 | Bias condition D; $V_{CB} = 25 \text{ V dc}$ | ΔI_{CBO1} <u>3/</u> | 100 percent of initial value or 5 nA dc, whichever is greater. ±25 percent change from initial reading. ±50 mV dc change from previously measured value. | | |
| 2. | Forward-current transfer ratio | 3076 | $V_{CE} = 1.0 \text{ V dc}$; $I_C = 3.0 \text{ mA dc}$ | Δh_{FE2} <u>3/</u> | | | |
| 3. | Collector-emitter voltage (saturated) | 3071 | $I_C = 10 \text{ mA dc}$; $I_B = 1.0 \text{ mA dc}$ | $\Delta V_{CE(sat)}$ <u>3/</u> | | | |

1/ The delta electrical measurements for table E-VIa (JANS) of MIL-PRF-19500 are as follows:

- a. Subgroup 4, see table II herein, step 3.
- b. Subgroup 5, see table II herein, steps 1, 2, and 3.

2/ The delta measurements for table E-VII of MIL-PRF-19500 are as follows: Subgroup 6, see table II herein, steps 1, 2, and 3 for JANS level.

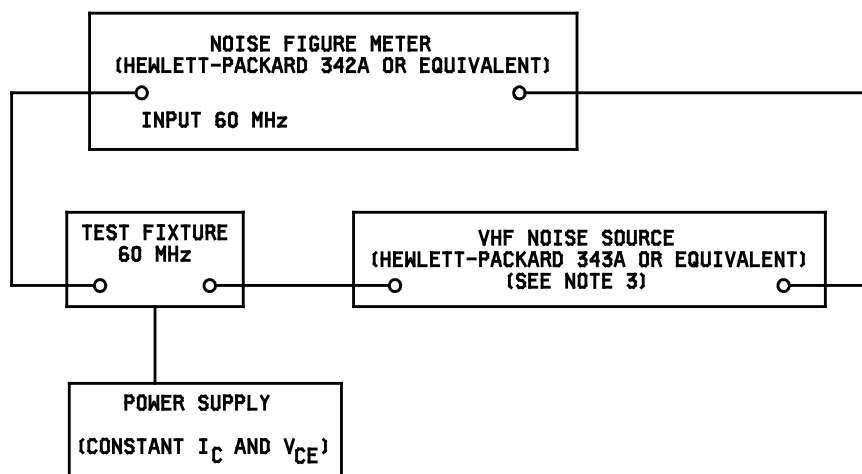
3/ The delta measurements for table E-IX of MIL-PRF-19500 and table III herein are as follows: Subgroups 1 and 2, see table II herein, steps 1, 2, and 3, all levels.

4/ Devices which exceed the table I limits for this test shall not be acceptable.

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TABLE III. Group E inspection (all quality levels) - for qualification or re-qualification only.

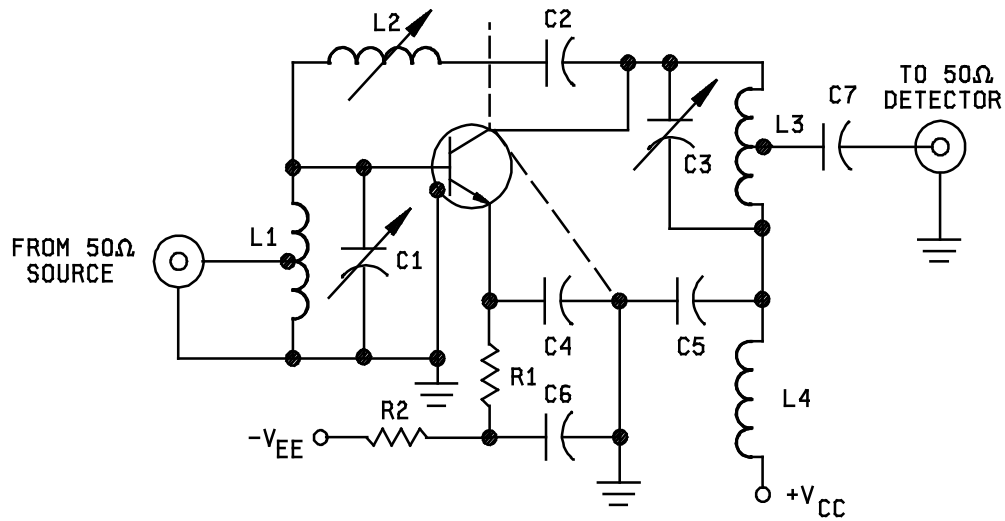
| Inspection | MIL-STD-750 | | Qualification |
|-------------------------------------|-------------|---|---------------------|
| | Method | Conditions | |
| <u>Subgroup 1</u> | | | 45 devices c = 0 |
| Temperature cycling (air to air) | 1051 | Test condition C, 500 cycles. | |
| Hermetic seal | 1071 | Test conditions G or H. Test conditions C or D. | |
| Fine leak | | | |
| Gross leak | | | |
| Electrical measurements | | See table I, subgroup 2 and table II herein. | |
| <u>Subgroup 2</u> | | | 45 devices c = 0 |
| Intermittent life | 1037 | Intermittent operation life: $V_{CB} = 10 \text{ V dc}$; 6,000 cycles, $t_{ON} = t_{OFF} = 3 \text{ minutes}$, $P_{D(ON)} = P_D \text{ max}$ rated in accordance with 1.3; $P_{D(OFF)} = 0$. | |
| Electrical measurements | | See table I, subgroup 2 and table II herein. | |
| <u>Subgroup 4</u> | | | |
| Thermal impedance curves | | See 4.2.2.1. | |
| <u>Subgroup 5</u> | | | |
| Not applicable | | | |
| <u>Subgroup 6</u> | | | 3 devices |
| ESD | 1020 | | |
| <u>Subgroup 8</u> | | | 45 devices c = 0 |
| Reverse stability | 1033 | Condition B. | |



NOTES:

1. The test fixture shall consist of a 60 MHz tuned amplifier and suitable biasing circuits. It should be constructed utilizing very high-frequency design techniques.
2. The effective source susceptance should be tuned for each device being tested to obtain minimum noise figure.
3. The HP-343A has a 50-ohm output resistance, therefore a suitable impedance transformer must be used to obtain an effective source conductance of 2.5 mmho at the transistor with minimum losses.

FIGURE 5. Block diagram for noise-figure test.

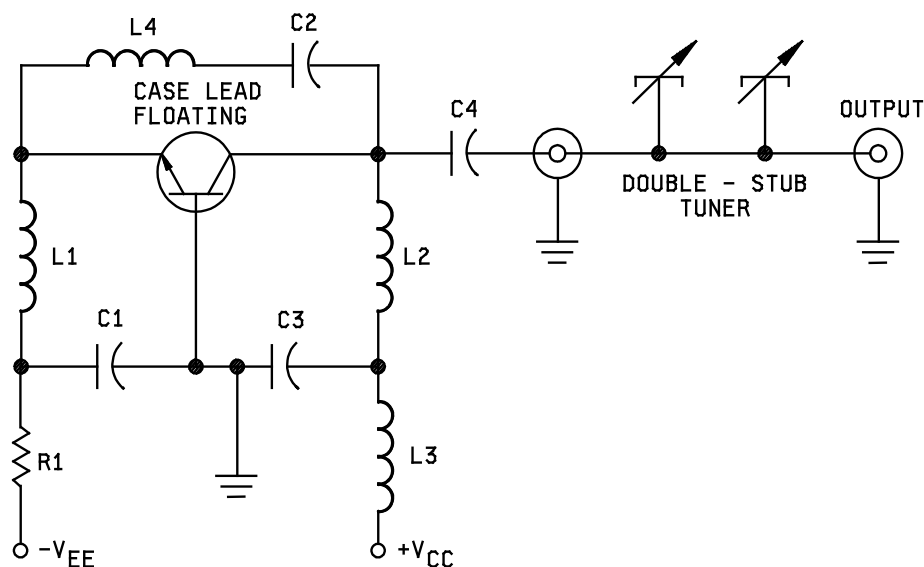
NEUTRALIZATION PROCEDURE:

- Connect a 200 MHz signal generator (with a 50 ohm output impedance) to the input terminals of the amplifier and connect a 50 ohm rf voltmeter to the output terminals of the amplifier.
- Apply V_{EE} and V_{CC} to obtain the specified test conditions.
- Adjust the output of the signal generator to approximately 10 millivolts and tune C1 and C3 for maximum output.
- Interchange the connections to the signal generator and rf voltmeter and with sufficient signal applied at the output terminals, tune L2 for a minimum indication on the rf voltmeter.
- Repeat this sequence until optimum settings are obtained for all variables.

CIRCUIT-COMPONENT INFORMATION:

| | |
|------------|---|
| C1: | 3-12 pF |
| C2 and C7: | 1,000 pF |
| C3: | 1.5 - 7.5 pF |
| C4 and C5: | 0.01 μ F |
| C6: | 0.05 μ F |
| L1: | 3½ T No. 16 AWG .313 inch (7.95 mm) ID, .438 inch (11.13 mm) length, turns ratio \cong 2 to 1 |
| L2: | 0.4 - 0.65 μ h, Miller No. 4303 (or equal) |
| L3: | 8 T No. 16 AWG, .125 inch (3.18 mm) ID, .875 inch (22.23 mm) length, turns ratio \cong 8 to 1 |
| L4: | 200 MHz RFC |
| R1: | 100 Ω |
| R2: | 1 k Ω |

FIGURE 6. Small-signal power gain.

**OSCILLATOR ADJUSTMENT PROCEDURE:**

Measurement of P_o shall be made in this circuit or a suitable equivalent. The circuit adjustment procedure is as follows:

- Set V_{CC} and V_{EE} to obtain the specified test conditions.
- Adjust the stub tuner to obtain the maximum output at the specified frequency of oscillation.
- Check I_C and reset if necessary.
- Read P_o .

NOTE: Collector efficiency (η), may be determined as follows:

$$\eta \text{ in } \% \frac{P_o}{120} \times 100 \quad \text{where } P_o \text{ is in milliwatts.}$$

CIRCUIT-COMPONENT INFORMATION:

- C1 and C3: 1,000 pF
- C2: 50 pF
- C4: 75 pF
- R1: 2.2 k Ω
- L1 and L3: 500 mC RFC
- L2: 2 turns No. 16 AWG, .375 inch (9.523 mm) OD, 1.250 inches (31.75 mm) length
- L4: 9 turns No. 22 AWG, .188 inch (4.78 mm) OD, .500 inch (12.70 mm) length

Double-stub tuner consists of the following commercially available components:

- 2 GR Type 874 TEE (or equivalent).
- 1 GR Type 874-D20 adjustable stub (or equivalent).
- 1 GR Type 874-LA adjustable line (or equivalent).
- 1 GR Type 874-WN3 short-circuit termination (or equivalent).

FIGURE 7. Oscillator power output.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the Military Service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory. The notes specified in MIL-PRF-19500 are applicable to this specification.)

6.1 Intended use. Semiconductors conforming to this specification are intended for original equipment design applications and logistic support of existing equipment.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Packaging requirements (see 5.1).
- c. Lead finish (see 3.4.1).
- d. Product assurance level and type designator.

* 6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List (QML 19500) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center, Columbus, ATTN: DSCC/VQE, P.O. Box 3990, Columbus, OH 43218-3990 or e-mail vqe.chief@dla.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <https://assist.daps.dla.mil>.

* 6.4 Suppliers of JANHC and JANKC die. The qualified JANHC and JANKC suppliers with the applicable letter version (example JANHCA2N918) will be identified on the QML.

| Die ordering information | | |
|--------------------------|----------------------------|-------------|
| PIN | Manufacturer | |
| | 34156 | 43611 |
| 2N918 2N918 | JANHCA2N918 JANKCA2N918 | JANHCB2N918 |

6.5 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:

Army - CR
Navy - EC
Air Force - 85
NASA - NA
DLA - CC

Preparing activity:

DLA - CC

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Review activities:

Army - AR, MI
Navy - AS, MC, SH
Air Force - 19, 99

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